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A
PROPOSAL
FOR MEASURING THE
ATTRACTION
OF
SOME HILL IN THIS KINGDOM
BY
ASTRONOMICAL OBSERVATIONS.

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BRITISH MUSEUM

A PROPOSAL, &c.

IF the attraction of gravity be exerted, as Sir ISAAC NEWTON ſuppoſes, not only between the large bodies of the univerſe, but between the minuteſt particles of which theſe bodies are compoſed, or into which the mind can imagine them to be divided, acting univerſally according to that law, by which the force which carries on the celeſtial motions is regulated; namely, that the accelerative force of each particle of matter towards every other particle decreaſes as the ſquares of the diſtances increaſe, it will neceſſarily follow, that every hill muſt, by its attraction, alter the direction of gravitation in heavy bodies in its neighbourhood from what it would have been from the attraction of the earth alone, conſidered as bounded by a ſmooth and even ſurface. For, as the tendency of heavy bodies downwards perpendicular to the earth's ſurface is owing to the combined attraction of all the parts of the earth upon it, ſo a neighbouring mountain ought, though in a far leſs degree, to attract the heavy body towards its centre of attraction, which cannot be placed far from the middle of the mountain. Hence the plumb-line of a quadrant, or any other aſtronomical inſtrument, muſt be deflected from its proper ſituation by a ſmall quantity towards the mountain; and the apparent altitudes of the ſtars, taken with the inſtrument, will be altered accordingly.

It will eaſily be acknowledged, that to find a ſenſible attraction of any hill from undoubted experiment would be a matter of no ſmall curioſity, would greatly illuſtrate the general theory of gravity, and would make the univerſal gravitation of matter palpable, if I may ſo expreſs myſelf, to every perſon, and fit to convince thoſe who will yield their aſſent to nothing but downright experiment. Nor would its uſes end here; as it would ſerve to give us a better idea of the total maſs of the earth, and the proportional denſity of the matter near the ſurface compared with the mean denſity of the whole earth. The reſult of ſuch an uncommon experiment, which I ſhould hope would prove ſucceſsful, would doubtleſs do honour to the nation where it was made, and the ſociety which executed it.

Sir ISAAC NEWTON gives us the firſt hint of ſuch an attempt, in his popular Treatiſe of the Syſtem of the World, where he remarks, "That a mountain of an he-
"miſpherical figure, three miles high and ſix broad, will
"not, by its attraction, draw the plumb-line two minutes
"out of the perpendicular." It will appear, by a very eaſy calculation, that ſuch a mountain would attract the plumb-line 1′ 18″ from the perpendicular.

But the firſt attempt of this kind was made by the French Academicians, who meaſured three degrees of the meridian near Quito in Peru, and who endeavoured to find the effect of the attraction of Chimboraço, a mountain

mountain in that neighbourhood, which iſ elevated near four miles above the ſea, though only about two miles above the general level of the province of Quito. By their obſervations of the altitudes of fixed ſtars taken with a quadrant of $2\frac{1}{2}$ feet radius, they found the quantity of 8″ in favour of the attraction of the mountain, by a mean of their obſervations. This, indeed, was much leſs than they expected; but then it is to be conſidered, that their inſtrument was too ſmall and imperfect for the purpoſe; and that they themſelves were ſubject to great inconveniencies, being ſheltered from the wind and weather by nothing but a common tent, and placed ſo high up the mountain as the boundary where the ſnow begins to lie unmelted all the year round. And indeed their obſervations, doubtleſs owing to theſe cauſes of error, differ greatly from one another, and are therefore inſufficient to prove the reality of an attraction of the mountain Chimboraço, although the general reſult from them is in favour of it. Accordingly, one of the French gentlemen themſelves, M. BOUGUER, who drew up the account of their experiment, expreſſes his wiſhes, that a like experiment might be made, to find the attraction of a mountain in France or England, where he thinks ſome might be found of ſufficient bulk for the purpoſe. This experiment and theſe remarks were made in the year 1738, or above thirty years ago, yet I believe no ſimilar experiment has ever been made in Europe.

I have made inquiries after a proper hill in this kingdom, for the trying of ſuch a curious experiment, and have

have been informed of two places in particular, extremely convenient for the purpoſe. The one is ſituated on the confines of Yorkſhire and Lancaſhire; where, within the compaſs of twenty miles, are ſituated four very remarkable hills, called Pendle-hill, Pennygant, Ingleborough, and Whernſide, which have been eſtimated to be from 600 to 750 yards elevated above the plane of the vales between them. By calculation on theſe *data*, it ſhould follow, that the ſum of the contrary attractions of Whernſide, the largeſt of theſe hills, on the plumb-line placed half-way up the hill, would not be leſs than 30″, and might amount to 46″, which it is evident is a very conſiderable quantity, and ſufficient to give us room to hope for a favourable and ſatisfactory ſucceſs of the experiment. The other place pointed out for this purpoſe, is a valley two miles broad, between the hills Helwellin and Skidda, in Cumberland; which hills, according to a plan of them and the adjacent country, communicated by Mr. SMEATON, F.R.S. are elevated above 1000 yards above the intermediate valley. By a calculation made according to this plan, the ſum of the contrary attractions of the plumb-line, placed alternately on the North-ſide of Helwellin and the South-ſide of Skidda, amounts to about 20″, which is likewiſe a quantity large enough for the experiment. And although the denſity of the earth near the ſurface ſhould be five times leſs than the mean denſity, as there is ſome reaſon to ſuſpect, and the attractions, as here ſtated, ſhould conſequently be diminiſhed in the proportion of five to one, ſtill the ſum of the contrary attractions of Whernſide would be 6″ or 9″, and the ſum of the contrary attractions of Helwellin and Skidda would be 4″; which quantities are not too ſmall to be meaſured and demonſtrated by an accurate zenith ſector, ſuch as that belonging to the Royal Society, which I made uſe of at St. Helena, would be, if the fault in the ſuſpenſion of the plumb-line, which I there diſcovered, was corrected, in the manner ſuggeſted in the Philoſophical Tranſactions, vol. LIV. p. 351.

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